REMARKS

Applicants appreciate the thorough and detailed examination of the present application as evidenced by the Office Action dated October 18, 2005 (hereinafter, the "Office Action"). Applicants further appreciate the indication that Claims 12, 13, 19, and 32-35 are allowed, and that Claims 45 and 52 would be allowable if rewritten in independent form. Applicants note that Claims 45 and 52 are herein rewritten in independent form, so that Claims 12, 13, 19, 32-35, 45 and 52 presently meet the Examiner's requirements for allowance.

Claims 1-8, 10-22, 24-26, 32-35, 37-40, 44-48, 51, 52, 54-59 and 62-66 are pending in the present application. Applicants have amended Claims 5, 7, 8, 10, 11, 14-16, 20, 24-26, 38-40, 44, 45, 48, 51, 52, 55, 56 and 64, and have canceled Claims 1-4, 6, 17, 18, 22, 37, 57-59, 62, 63, 65 and 66 herein without prejudice. Applicants submit that the pending claims are patentable over the cited references for at least the reasons discussed herein.

I. Claim Rejections Under 35 U.S.C. §112, first paragraph

Claims 3 and 4 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. *See* Office Action, page 2.

Applicants have canceled Claims 3 and 4 herein without prejudice, thus obviating the present rejection. Accordingly, Applicants respectfully request that the rejection of Claims 3 and 4 under 35 U.S.C. §112, first paragraph, be withdrawn.

Claim 8 stands rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The Office Action states that there is no support in the original disclosure for the generic term "vinylsilane." *See* Office Action, page 2. Applicants respectfully disagree.

Applicants respectfully submit that there is support in the original disclosure for the generic term vinylsilane. First, the specification, on page 8, para. 46, states that "[s]ilanes that may be used as silicon-containing monomers with embodiments of the present invention include, *but are not limited to*, dimethylphenyvinylsilane, dimethylphenysilane, triethylsilane, and dimethylethylsilane." Emphasis added. The instant specification lists examples of silanes, which include a specific vinylsilane,

without meaning to be limited to the particular silanes disclosed. In addition, Applicants respectfully point out that Claim 38, as originally filed, recites a silicon-containing monomer selected from the group consisting of silylstyrene and *vinylsilane*. Therefore, Applicants submit that in addition to the implicit disclosure in the specification described above, vinylsilane is also explicitly disclosed to be a silicon-containing monomer that may be used in embodiments of the invention. At least in view of the foregoing, Applicants submit that the rejection of Claim 8 under 35 U.S.C. §112, first paragraph, is overcome, and thus, Applicants respectfully request that the rejection be withdrawn.

II. Claim Rejections Under 35 U.S.C. § 112, second paragraph

Claim 39 stands rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Office Action states that the recitation in Claim 39 that the monomer comprises a polymer is improper. Further, the Office Action requests clarification of the term "vinyl." *See* Office Action, page 3.

Claim 39 has been amended herein to clarify the recitation that the monomer is selected from the group consisting of isoprene and vinyl compounds. The term "vinyl" is well-known to one of skill in the art. As Hawley's Condensed Chemical Dictionary (13th edition) states, a vinyl compound is "a compound having the vinyl grouping (CH_2=CH-), specifically vinyl chloride, vinyl acetate, and similar esters but also referring more generally to compounds such as styrene $C_6H_5CH=CH_2$, methyl methacrylate $CH_2=C(CH_3)COOCH_3$, and acrylonitrile CH_2=CHCN." Thus, Applicants submit that the term need not be further defined in the specification, as it is well known in the field of polymer chemistry. At least in view of the foregoing, Applicants submit that the rejection of Claim 39 under 35 U.S.C. §112, second paragraph, is overcome, and thus, Applicants respectfully request that the rejection be withdrawn.

Claims 26 and 48 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject

matter which Applicants regard as the invention. The Office Action again requests clarification of the term "vinyl." *See* Office Action, page 3.

For at least the reasons described above with reference to Claim 39, Applicants submit that the term "vinyl compounds," as presently recited in Claims 26 and 48, is not indefinite. Thus, at least in view of the foregoing, Applicants submit that the rejection of Claims 26 and 48 under 35 U.S.C. §112, second paragraph, is overcome, and Applicants respectfully request that the rejection be withdrawn.

III. Claim Rejections Under 35 U.S.C. § 102(b) in View of Leveriza et al.

Claims 1-4, 6, 8, 17, 20-22, 37-40, 57, 58, 65 and 66 stand rejected under §102(b) as anticipated by U.S. Patent No. 4,764,247 to Leveriza et al. (hereinafter, "Leveriza"). The Office Action states that Leveriza teaches a photoresist material used in the production of semiconductor devices comprising a copolymer of trimethylsilylstyrene and chloromethylstyrene. The Office Action further states that the copolymer of trimethylsilylstyrene and chloromethylstyrene teaches the first polymer listed in present Claim 20. *See* Office Action, pages 3-4.

Claims 1-4, 6, 17, 22, 37, 57, 58, 65 and 66 are herein canceled without prejudice. Thus, the rejection under 35 U.S.C. §102(b) is obviated with respect to these claims, and so the rejection will only be discussed further as it relates to Claims 8, 20, 21 and 38-40.

Claim 8 is herein amended to recite a silane-containing resist polymer comprising vinylsilane. As this recitation is neither taught nor suggested by Leveriza, Applicants respectfully submit that the rejection of Claim 8 has been overcome.

Claim 20 is herein amended to exclude the trimethylsilylstyrene-co-chloromethylstyrene polymer. Leveriza does not teach or suggest any of the currently recited polymers. Thus; Applicants submit that the rejection of Claim 20 has been overcome. Further, Applicants submit that Claim 21 is also patentable, at least per the patentability of Claim 20, from which it depends.

Claim 38 is herein amended to recite a method of forming a silane-containing resist copolymer, comprising: copolymerizing a monomer and a silane-containing monomer to form a silane-containing resist copolymer, wherein the silane-containing

monomer is vinylsilane. As Leveriza neither teaches nor suggests copolymerizing a monomer with vinylsilane, Applicants submit that the rejection of Claim 38 has been overcome. Applicants further submit that Claims 39 and 40 are also patentable, at least per the patentability of Claim 38, from which they depend.

At least in view of the foregoing, Applicants submit that the claim rejections in view of Leveriza have been overcome, and Applicants respectfully request that the claim rejections under 35 U.S.C. §102(b) in view of Leveriza be withdrawn.

IV. Claim Rejections Under 35 U.S.C. § 102(b) in View of Watanabe

Claims 1-4, 6, 8, 18, 20-22, 37-40, 57, 58, 65 and 66 stand rejected under §102(b) as being anticipated by JP 62-280839 to Watanabe (hereinafter, "Watanabe"). The Office Action states that Watanabe teaches a resist material containing the copolymer of pentamethyldisilylstyrene and chloromethylstyrene. *See* Office Action, page 4.

Claims 1-4, 6, 18, 22, 37, 57, 58, 65 and 66 are herein canceled without prejudice. Thus, the present §102(b) rejection is obviated with respect to these claims, and so the rejection will only be discussed further as it relates to Claims 8, 20, 21, and 38-40.

Claim 8 is herein amended to recite a silane-containing resist polymer comprising vinylsilane. As this recitation is neither taught nor suggested by Watanabe, Applicants respectfully submit that the rejection to Claim 8 has been overcome.

Claim 20 is herein amended to exclude the pentamethyldisilylstyrene-co-chloromethylstyrene polymer. Watanabe does not teach or suggest any of the currently recited polymers. Thus, Applicants submit that the rejection of Claim 20 has been overcome. Further, Applicants submit that Claim 21 is also patentable, at least per the patentability of Claim 20, from which it depends.

Claim 38 is herein amended to recite a method of forming a silane-containing resist copolymer, comprising: copolymerizing a monomer and a silane-containing monomer to form a silane-containing resist copolymer, wherein the silane-containing monomer is vinylsilane. As Watanabe neither teaches nor suggests copolymerizing a

monomer with vinylsilane, Applicants submit that the rejection of Claim 38 has been overcome. Applicants further submit that Claims 39 and 40 are also patentable, at least per the patentability of Claim 38, from which they depend.

At least in view of the foregoing, Applicants submit that the claim rejections in view of Watanabe have been overcome, and Applicants respectfully request that the claim rejections under 35 U.S.C. §102(b) in view of Watanabe be withdrawn.

V. Claim Rejections Under 35 U.S.C. § 102(b) in View of Felter et al.

Claims 1-4, 22, 37, 40, 57, 58, 65 and 66 stand rejected under §102(b) as being anticipated by U.S. Patent No. 5,989,776 to Felter et al. (hereinafter, "Felter"). The Office Action states that Felter teaches a method of producing a patterned array of features in the size range of 0.4-.05 μm using projection lithography and extreme ultraviolet radiation. The Office Action further states that Felter performs the lithography by using a photoresist composition containing an organosilicon polymer such as poly(cyclohexylmethyl-co-trimethylsilylmethyl silane). *See* Office Action, page 4.

Claims 1-4, 22, 37, 57, 58, 65, and 66 are herein canceled without prejudice. Thus, the present §102(b) rejection is obviated with respect to these claims, and so the rejection will only be discussed further as it relates to Claim 40.

Claims 40 is herein amended to recite a method of forming a silane-containing resist copolymer, comprising: copolymerizing a monomer and a silane-containing monomer to form a silane-containing resist copolymer, wherein the silane-containing monomer is vinylsilane, and wherein the silicon-containing resist copolymer comprises between about 0.1 percent and about 40 percent by weight silicon. Felter neither teaches nor suggests copolymerizing a monomer and vinylsilane to form a silicon-containing resist polymer comprising between about 0.1 percent and about 40 percent by weight silicon. Thus, at least in view of the foregoing, Applicants submit that the rejection to Claim 38 has been overcome, and Applicants respectfully request that the rejection under 35 U.S.C. §102(b) in view of Felter be withdrawn.

VI. Claim Rejections Under 35 U.S.C. § 102(b) in View of Matsumoto et al.

Claims 24, 25, 44, 46, 47, 51, 54 and 56 stand rejected under §102(b) as anticipated by U.S. Patent No. 5,386,006 to Matsumoto et al. ("Matsumoto"). The Office Action states that Matsumoto teaches polysilazanes with boron-carbon bonded substituents on the polysilazane backbone, which are prepared by the hydroboration of alkenyl or alkynyl-substituted polysilazanes. The Office Action further states that Matsumoto teaches that preferably the boron content is 0.3-1.0 weight percent in the polymer. *See* Office Action, page 5.

Claims 24, 25, 44, 46, 47, 51, 54 and 56 as herein amended to recite boron-containing *resist* polymers. Matsumoto is directed toward preceramic polymers incorporating boron and their application in the sintering of SiC ceramics. *See* Matsumoto, abstract. Thus, the preceramic polymers of Matsumoto do not anticipate the claims at issue, for at least the reason that they are not resist polymers. Thus, Applicants submit that the rejection of Claims 24, 25, 44, 46, 47, 51, 54 and 56 has been overcome, and Applicants respectfully request that the claim rejections under 35 U.S.C. §102(b) in view of Matsumoto be withdrawn.

VII. Claim Rejection Under 35 U.S.C. § 102(b) in View of Chung et al.

Claim 55 stands rejected under §102(b) as being anticipated by U.S. Patent No. 5,247,023 to Chung et al. (hereinafter, "Chung"). The Office Action states that Chung teaches polymeric hydrocarbon compounds having reactive borane groups at chain ends, or within the polymer chain. The Office Action further alleges that such compounds are made by an olefin exchange reaction between an unsaturated high molecular weight polymer and a borane monomer. *See* Office Action, page 5.

Claim 55 is herein amended to recite a method for increasing the reactive ion etch resistance of a resist polymer by incorporating boron atoms into a *resist* polymer. Chung is directed toward borane polymers that are intermediates for the synthesis of other functional polymers, *see* Chung, col. 3, line 36-39, and not toward resist polymers, or increasing reactive etch resistance. Thus, Applicants submit that the rejection of Claim 55 has been overcome, and Applicants respectfully request that the rejection under 35 U.S.C. §102(b) in view of Chung be withdrawn.

VIII. Claim Rejections Under 35 U.S.C. § 103(a) over Felter in view of Lin

Claims 59 and 62-64 stand rejected under §103(a) as being unpatentable over Felter in view of U.S. Patent No. 5,304,453 to Lin (hereinafter,"Lin"). The Office Action alleges that Felter teaches a method of producing a patterned array of features in the size range of 0.4-0.5 μm using projection lithography and extreme ultraviolet radiation by using a photoresist composition containing an organosilicon polymer such as poly(cyclohexylmethyl-co-trimethylsilylmethyl silane). The Office Action further alleges that the oxygen plasma etching in Felter is interchangeable with oxygen reactive ion etching, as evidenced by Lin. *See* Office Action, pages 5-6.

Claims 59, 62 and 63 are herein canceled without prejudice. Thus, the present §103(a) rejection has been obviated as it applies to these claims, and so the rejection will only be discussed further as it applies to Claim 64.

Claim 64 recites as follows:

> In a method of making a feature on a substrate by: (a) coating said substrate with a resist composition comprising a polymer; (b) exposing the resist composition to extreme ultra-violet radiation; and then (c) reactive ion etching said resist to form the feature thereon, the improvement comprising:
> including silane in said polymer, wherein said feature has at least one dimension less than 50 nm.

As the Office Action admits, Felter describes a method of producing a patterned array of features in the size range of 0.4-0.05 μm. Claim 64, however, recites features having at least one dimension less than 50 nm. As Felter does not teach or suggest a method of creating features less than 50 nm, Applicants submit that Felter does not render Claim 64 obvious. Further, Lin does not remedy the deficiencies of Felter. More specifically, Lin does not teach or suggest including silane in the polymer, wherein the feature has at least one dimension less than 50 nm as recited in Claim 64. Thus, Applicants submit that Claim 64 is not rendered obvious by Felter in view of Lin, and Applicants respectfully request that the rejection of Claim 64 under 35 U.S.C. §103(a) be withdrawn.

IX. Claim Rejections Under 35 U.S.C. § 103(a) over Ober et al.

Claims 1-7, 10, 11, 14-16, 22, 57, 58, 65 and 66 stand rejected under §103(a) as being unpatentable over U.S. Patent No. 5,290,397 to Ober et al. (hereinafter, "Ober"). The Office Action states the following:

> Ober teaches E-beam exposure and development of *pentamethyldistiloxane* modified polystyrene-polyisoprene block copolymer, which contains a silicon weight percent of *at least about 5 percent.* Ober teaches that the silicon component is incorporated into the block copolymer using a *hydrosilylation* reaction. Ober also teaches that instead of hydrosiloxane such as pentamethyldisiloxane, *hydrosilanes* can also be used in incorporating the silicon component into the block copolymer. Therefore, it would have been obvious to form a hydrosilane modified polystyrene-polyisoprene block copolymer with a reasonably expectation of obtaining a bilayer resist which provides resolution, sufficient etching protection yet also exhibits dimensional stability.

See Office Action, pages 6-7. *Citations omitted, emphases in original.*

Claims 1-4, 6, 22, 57, 58, 65 and 66 are herein canceled without prejudice. Thus, the present §103 (a) rejection has been obviated with respect to these claims, and so the rejection will only be discussed further as it relates to Claims 5, 7, 10, 11 and 14-16.

To establish a *prima facie* case of obviousness, the USPTO must satisfy three requirements. First, the prior art reference or combination of references must teach or suggest all of the recitations of the claims. *See In re Wilson*, 424 F.2d 1382, 1385, 165 U.S.P.Q. 494, 496 (CCPA 1970) ("All words in a claim must be considered in judging the patentability of that claim against the prior art"). Importantly, the teachings must come from the prior art, not from the Appellant's disclosure. *See In re Vaeck*, 947 F.2d 488, 493, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991). Second, the cited art relied upon, coupled with the knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references. *In re Oetiker*, 24 U.S.P.Q.2d 1443, 1446 (Fed. Cir. 1992); *In re Fine*, 837 F.2d at 1074; *In re Skinner*, 2 U.S.P.Q.2d 1788, 1790 (Bd. Pat. App. & Int. 1986). Third, the proposed modification or combination of the prior art must have a reasonable expectation of

success, determined from the vantage point of the skilled artisan at the time the invention was made. *See Amgen, Inc. v. Chugai Pharm. Co.*, 927 F2d 1200, 1209, 18 U.S.P.Q.2d 1016, 1023 (Fed. Cir. 1991).

The Court of Appeals for the Federal Circuit has stated that, to support combining or modifying references, there must be particular evidence from the prior art as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed. *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000). Furthermore, the invention must be considered as a whole to avoid hindsight reasoning in which the invention is used as a roadmap to piece together prior art components. *Ruiz v. A.B. Chance*, 357 F.2d 1270, 1275 (Fed. Cir. 2004). "Hindsight is a tempting but forbidden zone." *Loctite Corp. v. Ultraseal Ltd.*, 228, USPQ 90, 98 (Fed. Cir. 1985). The standard of obviousness is not whether, in hindsight, it seems elementary that someone would have combined the elements in the prior art to form the invention in question. *See W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 220 USPQ 303 (Fed. Cir. 1983). Thus, clarifying the proper obviousness standard, Applicants reiterate that there must be some suggestion in the art, beyond the teachings of the application at issue, to combine (or modify) the references in a manner which yields the invention. *See Arkie Lures Inc. v. Gene Larew Tackle, Inc.*, 43 USPQ2d at 1297 (emphasis added).

Ober is directed toward bilayer photoresist compositions for **conventional lithography** techniques, such as E-beam exposure. Toward this end, the examples relate to the incorporation of a siloxane into a resist composition. Indeed, the emphasis in Ober on siloxane-based resists is not surprising considering that the described photoresists are designed for use in conventional lithography. As one of skill in the art understands, the Si-O bond may be transparent at conventional wavelengths, such as 157 nm, so that siloxanes are suitable resist materials at those wavelengths.

In contrast to Ober, embodiments of the present invention are directed toward photoresist compositions for **extreme ultraviolet lithography (EUV)**. As described in the instant specification, the absorption of resist materials is a key area of concern when designing photoresist materials for EUV lithography, and the incorporation of

oxygen into EUV resists is undesirable because oxygen is highly absorbing at EUV wavelengths, such as 13.4 nm. *See* specification, page 2, para. 5. Thus, siloxane-based resists generally are not desirable in EUV lithography applications because they have a high oxygen content. One of ordinary skill in the art would not be motivated to apply photoresists including a high oxygen content to EUV applications instead of conventional lithography processes. Applicants respectfully submit that the Examiner has engaged in impermissible and improper hindsight reconstruction to establish the present rejection. In particular, the motivation or suggestion to make the resist compositions of Claims 5, 7, 10, 11, and 14-16 can only be found, if at all, in the Ober reference, through the impermissible use of hindsight. Stated another way, it appears that the Office Action gains its alleged impetus or suggestion to modify the prior art by hindsight reasoning informed by Applicants' disclosure, which, as noted above, is an inappropriate basis for modifying a reference.

Specifically, Claim 5 as amended herein recites a resist composition, comprising a silane-containing resist polymer, wherein the silane-containing resist polymer comprises isoprene. As stated in the Office Action, Ober teaches a *siloxane*-containing resist that includes isoprene. For at least the reasons described above, Applicants submit that one of ordinary skill in the art would not be motivated to modify the siloxane-containing resists of Ober to reach the silane-containing resists recited in Claim 5, absent the benefit of hindsight reconstruction.

Claim 7 as amended herein recites the resist composition of Claim 5, wherein the silane-containing resist polymer further comprises styrene. Applicants submit that Claim 7 is not rendered obvious by Ober, at least per the patentability of Claim 5, from which Claim 7 depends.

Claim 10 as amended herein recites a resist composition, comprising a silane-containing resist polymer, wherein the silane-containing resist polymer comprises a polymer formed by the hydrosilylation of isoprene. As stated in the Office Action, Ober teaches an isoprene monomer that is hydrosilylated by a *hydrosiloxane*, not a hydrosilane. For at least the reasons described above, Applicants submit that one of ordinary skill in the art would not be motivated to replace the hydrosiloxane of Ober

with the hydrosilane moiety recited in Claim 10, absent the benefit of hindsight reconstruction.

Claim 11 as amended herein recites a resist composition, comprising the resist composition of Claim 10, wherein the hydrosilylation agent is selected from the group consisting of dimethylphenylsilane, triethylsilane, and dimethylsilane. Applicants submit that Claim 11 is not rendered obvious by Ober, at least per the patentability of Claim 10, from which Claim 11 depends. Applicants further note that Ober does not teach or suggest hydrosilylation with dimethylphenylsilane, triethylsilane, or dimethylsilane.

Claim 14 as amended herein recites a resist composition, comprising a silane-containing resist polymer wherein the silane-containing resist polymer comprises poly(styrene-b-isoprene) having a molecular weight between about 5,500 and about 21,800. As described above, Ober describes a *siloxane*-containing resist that includes poly(styrene-b-isoprene). For at least the reasons described above, Applicants submit that one of ordinary skill in the art would not be motivated to modify the siloxane-containing resist of Ober to reach the silane-containing resist recited in Claim 15, absent the benefit of hindsight reconstruction.

Claim 15 as amended herein recites the resist composition of Claim 14, wherein the silane-containing resist polymer comprises poly(styrene-b-isoprene) having a molecular weight between about 5,500 and about 5,700. Applicants submit that Claim 15 is not rendered obvious by Ober, at least per the patentability of Claim 14, from which Claim 15 depends.

Claim 16 as amended herein recites the resist composition of Claim 14, wherein the silane-containing resist polymer comprises poly(styrene-b-isoprene) having a molecular weight between about 7,200 and about 21,800. Applicants submit that Claim 16 is not rendered obvious by Ober, at least per the patentability of Claim 14, from which Claim 16 depends.

Accordingly, for at least the reasons described above, Applicants submit that Claims 5, 7, 10, 11 and 14-16 are not obvious in view of Ober. Thus, Applicants respectfully request that the rejection of these claims under 35 U.S.C. §103(a) be withdrawn.

X. Allowable Subject Matter

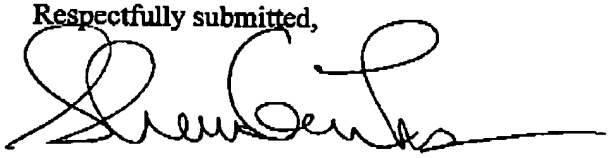
Claims 45 and 52 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the recitations of the base claim and any intervening claims. *See* Office Action, page 8.

As noted above, Claims 45 and 52 have been rewritten in independent form as suggested by the Examiner. Accordingly, Applicants respectfully request allowance of these claims.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully request that all outstanding rejections to the claims be withdrawn and that a Notice of Allowance be issued in due course. The Examiner is invited and encouraged to contact the undersigned directly if such contact will expedite the prosecution of the pending claims to issue. In any event, any questions that the Examiner may have should be directed to the undersigned, who may be reached at (919) 854-1400.

Respectfully submitted,



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CERTIFICATION OF FACSIMILE TRANSMISSION UNDER 37 CFR § 1.8

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Susan E. Freedman

Susan E. Freedman
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